Claims

1. (Currently amended) A thermoelectric power source comprising:

a flexible substrate having an upper surface; and

a thermoelectric couple comprising:

(a) a sputter deposited thin film p-type thermoelement positioned on the upper surface of the flexible substrate;

(b) a sputter deposited thin film n-type thermoelement positioned on the upper surface of the flexible substrate adjacent the p-type thermoelement; and

(c) an electrically conductive member positioned on the flexible substrate, and electrically connecting the first end of the p-type thermoelement ~~is in electrical contact~~ with the second end of the n-type thermoelement.

2. (Original) The thermoelectric power source of claim 1 wherein the p-type or the n-type thermoelements have L/A ratios greater than about 20 cm^{-1}.

3. (Original) The thermoelectric power source of claim 1 wherein the p-type or the n-type thermoelements have L/A ratios greater than about 100 cm^{-1}.

4. (Original) The thermoelectric power source of claim 1 wherein the p-type or the n-type thermoelements comprise Bi_aTe_b where a is about 2 and b is about 3.

5. (Original) The thermoelectric power source of claim 1 wherein the p-type or the n-type thermoelements are selected from the group Bi_xTe_y, Sb_xTe_y, and Bi_xSe_y alloys where x is about 2 and y is about 3.

6. (Original) The thermoelectric power source of claim 1 further comprising at least about 50 thermoelectric couples, wherein the thermoelectric power source has a power output of at least 1 μW with a voltage of at least at least 0.25 volt.

7. (Original) The thermoelectric power source of claim 6 wherein the p-type or the n-type thermoelements are at least about 1 mm in length and at least about 0.1 mm in width.

8. (Original) The thermoelectric power source of claim 6 wherein the p-type or the n-type thermoelements are at least about 20 angstroms in thickness.

9. (Original) The thermoelectric power source of claim 1 further comprising at least about 1000 thermoelectric couples, wherein the thermoelectric power source has a power output of about 1W with a voltage of at least about 1 volt.

10. (Original) The thermoelectric power source of claim 1 wherein the p-type thermoelements have different widths as compared to the n-type thermoelements.

11. (Original) The thermoelectric power source of claim 1 wherein two or more p-type thermoelements are positioned and electrically connected in parallel with one another and the parallel positioned p-type thermoelements are electrically connected in series to n-type thermoelements.

12. (Original) The thermoelectric power source of claim 1 further including multiple thermoelectric couples electrically connected in series on the upper surface of the flexible substrate and wherein the flexible substrate is in a coil configuration.

13. (Original) The thermoelectric power source of claim 1 wherein the volume of the thermoelectric power source is less than about 10 cm^3 and has a power output of from about 1 μW to about 1 W.

14. (Original) The thermoelectric power source of claim 1 wherein the volume of the thermoelectric power source is less than about 10 cm^3 and provides voltages of greater than about 1 volt.

15. (Original) The thermoelectric power source of claim 14 wherein the thermoelectric power source produces power at temperature differences of about 20°C or less.

16. (Original) The thermoelectric power source of claim 1 wherein two or more n-type thermoelements are positioned and electrically connected in parallel with one another and the parallel positioned n-type thermoelements are electrically connected in series to p-type thermoelements.

17. (Original) The thermoelectric power source of claim 1 wherein the n-type thermoelements are substantially free of selenium.

18. (Original) The thermoelectric power source of claim 1 wherein the flexible substrate is a polyimide.

19. (Original) The thermoelectric power source of claim 1 wherein the p-type thermoelement is a superlattice.

20. (Original) The thermoelectric power source of claim 19 wherein the superlattice comprises alternating Bi_2Te_3 and Sb_2Te_3 layers with thicknesses between about 50 Å and about 150 Å.

21. (Original) The thermoelectric power source of claim 1 wherein the n-type thermoelement is a superlattice.

22. (Original) The thermoelectric power source of claim 21 wherein the superlattice comprises alternating Bi_2Te_3 and Sb_2Te_3 layers with thicknesses between about 50 Å and about 150 Å.

23. (Original) A thermoelectric power source comprising:

a flexible substrate having an upper surface;

multiple thermocouples electrically connected to one another on the upper surface of the flexible substrate, the thermocouples comprising:

sputter deposited thin film p-type thermoelements;

sputter deposited thin film n-type thermoelements alternatingly positioned adjacent the p-type thermoelements; and

wherein the thermoelectric power source has a volume of less than about 10 cm^3 and has a power output of from about 1 μW to about 1 W.

24. (Original) The thermoelectric device of claim 23 wherein said multiple thermocouples electrically connected to one another in series or in series-parallel.

25. (Original) The thermoelectric power source of claim 23 wherein the p-type thermoelements have different widths as compared to the n-type thermoelements.

26. (Original) A method for fabricating thermoelectric power sources comprising:

providing a flexible substrate;

sputter depositing multiple thin films of n-type thermoelectric material onto the flexible substrate;

sputter depositing multiple thin films of p-type thermoelectric material onto the flexible substrate; and

forming multiple thermocouples on the flexible substrate by electrically connecting the thin films of p-type thermoelectric material to the thin films of n-type thermoelectric materials.

27. (Original) The method of claim 26 wherein the thermoelectric power source is fabricated to have a volume of less than about 10 cm^3 and to provide voltages of greater than about 1 volt.

28. (Original) The method of claim 26 wherein the p-type or the n-type thermoelements are sputter deposited to have L/A ratios greater than about 50 cm^{-1}.

29. (Original) The method of claim 26 wherein the p-type or the n-type thermoelement materials are sputter deposited to have L/A ratios greater than about 20 cm^{-1}.

30. (Original) The method of claim 26 the p-type or the n-type thermoelement materials sputter deposited to form thin films of Bi_xTe_y, Sb_xTe_y, and Bi_xSe_y alloys where x is about 2 and y is about 3.

31. (Original) The method of claim 26 further comprising winding the flexible substrate into a coil configuration.

32. (Original) The method of claim 27 further comprising activating thermoelectric power source by a temperature gradient of about 20°C or less.

33. (Original) The method of claim 26 wherein targets used for sputter depositing a thin film of n-type or p-type thermoelectric material onto a flexible substrate comprise Sb_2Te_3 and Bi_2Te_3.

34. (Original) The method of claim 33 wherein an RF power of about 30 watts is supplied to the Sb_2Te_3 target and an RF power of about 10 watts is supplied to the Bi_2Te_3 target to sputter deposit the thin film of p-type thermoelectric material.

35. (Original) The method of claim 32 wherein an RF power of about 30 watts is supplied to the Sb_2Te_3 target and an RF power of about 20 watts is supplied to the Bi_2Te_3 target to sputter deposit the thin film of n-type thermoelectric material.

36. (Original) The method of claim 26 wherein a sputtering gas pressure is maintained at about 3 millitorr during the sputter deposition of the thin film of n-type thermoelectric material.